Variability of the Florida Current Transport at 27^{o}N

G. Peng*, Z. Garraffo, G. R. Halliwell, V. Kourafalou

RSMAS/University of Miami, Miami

* Raytheon Company, Pasadena

O.-M. Smedstad

Planning Systems, Inc, Stennis Space Center

C. S. Meinen

AOML/NOAA, Miami

Ocean Science Meeting 2008

2 – 7 March 2008

Orlando, Florida

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE **MAR 2008**	2. REPORT TYPE	3. DATES COVERED **00-00-2008 to 00-00-2008**
4. TITLE AND SUBTITLE **Variability of the Florida Current Transport at 27oN**		5a. CONTRACT NUMBER
		5b. GRANT NUMBER
		5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)		5d. PROJECT NUMBER
		5e. TASK NUMBER
		5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **University of Miami,Rosenstiel School of Marine and Atmospheric Science,Miami,FL,33149**		8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR’S ACRONYM(S)
		11. SPONSOR/MONITOR’S REPORT NUMBER(S)
12. DISTRIBUTION/AVAILABILITY STATEMENT **Approved for public release; distribution unlimited**		
13. SUPPLEMENTARY NOTES		
14. ABSTRACT		
15. SUBJECT TERMS		

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**18**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Outline

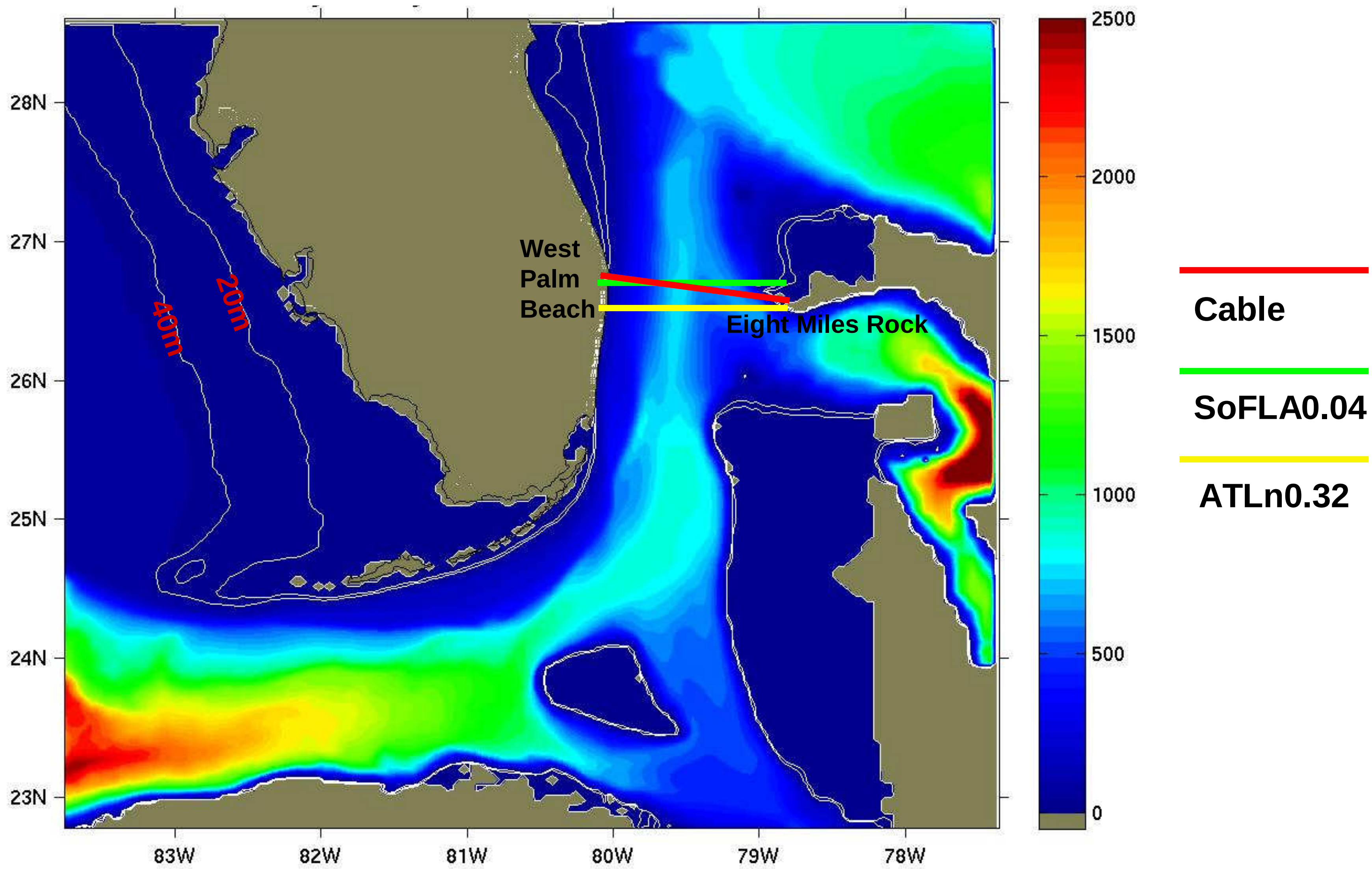
- Seasonal variability from observations (1982-2005)
- Impact of boundary conditions – using HYCOM GODAE products in the HYCOM-SoFLA domain (2004)
- Inter-annual and decadal variability from model results (1950-2003)
- Summary
- Acknowledgement

Data outline:

- **Daily Florida Current transport derived from the submarine telephone cable voltage measurements from 1982 to 2005**

- **Shipboard velocity measurements using the Dropsonde float from 1991-2005 (total 157 dropsonde section transport estimates)**

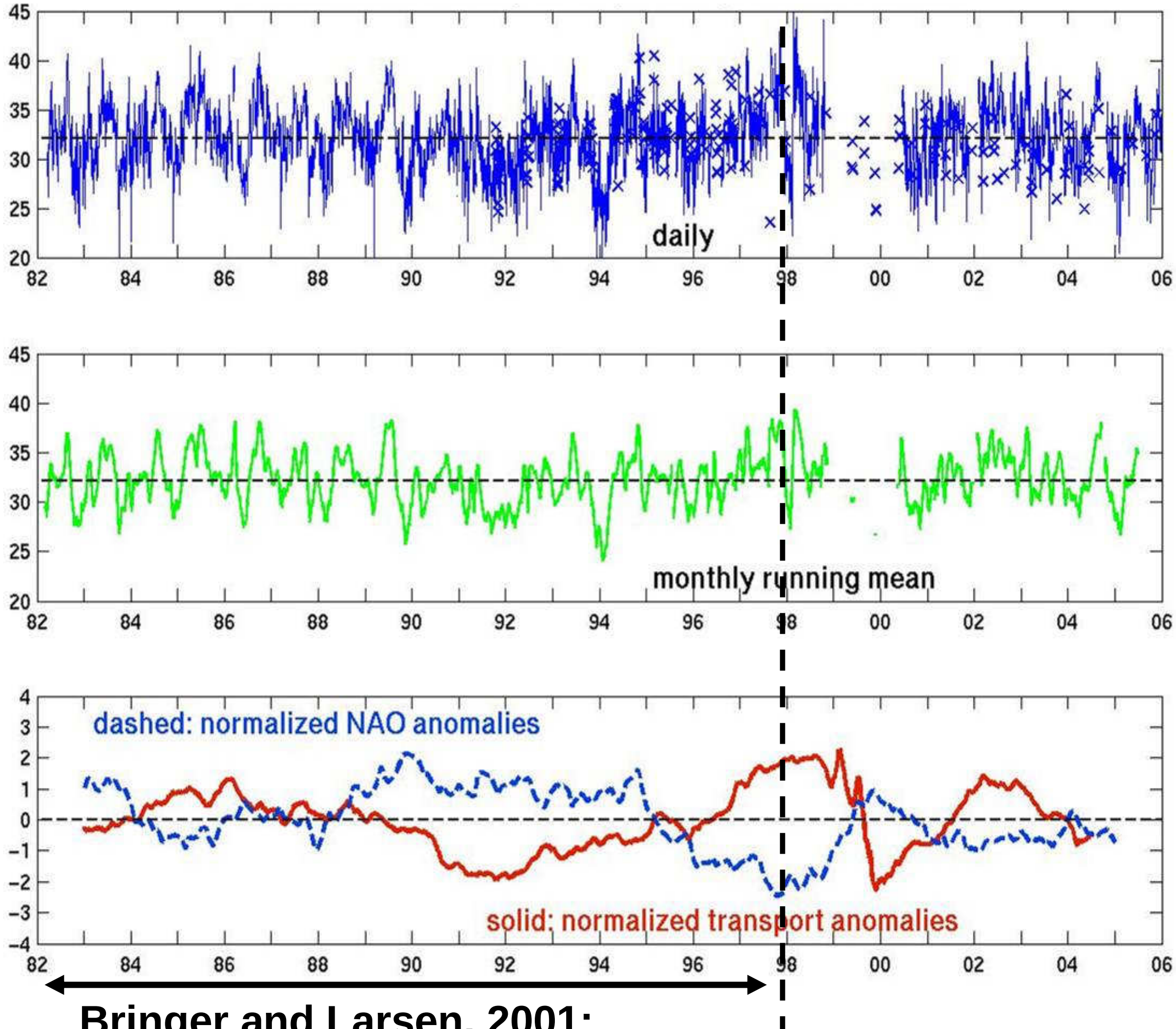
Locations of the Cable and Model Sections



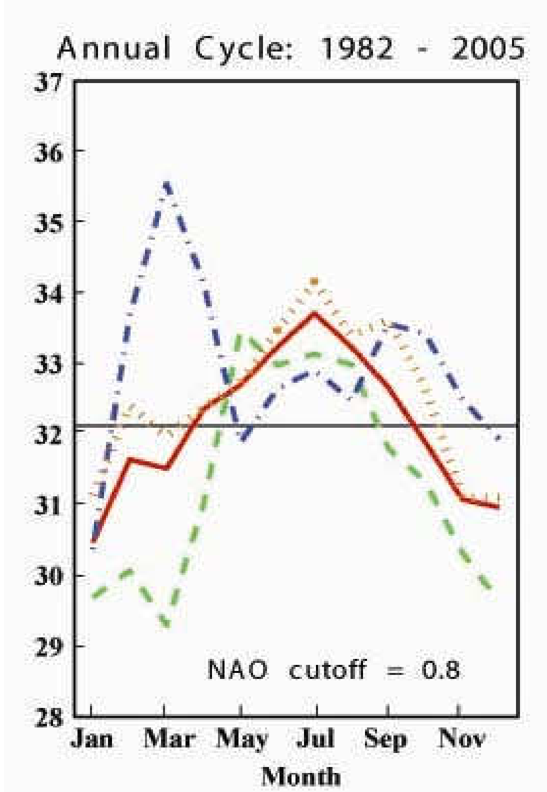
Bathymetry in SoFLA0.04 Domain

Florida Current Transport

Cable data 1982 – 2005/Cruise data 1991-2005



Bringer and Larsen, 2001: Good negative correlation between FC transport and NAO.



Solid: ALL NAO

Dashed: Strong positive NAO

Dash-dotted: Strong negative NAO

Dotted: Other NAO

The Cable and cruise data are from www.aoml.noaa.gov/phod/floridacurrent

Statistic Characteristics: Cable

Florida Current Transport: 1982 - 2005

	Mean	Min	Max	STD
ALL NAO	32.12	30.46	33.71	1.02
Strong Positive NAO	31.31	29.3	33.46	1.54
Strong Negative NAO	32.92	30.37	35.54	1.3
Others	32.51	31.1	34.16	1.04

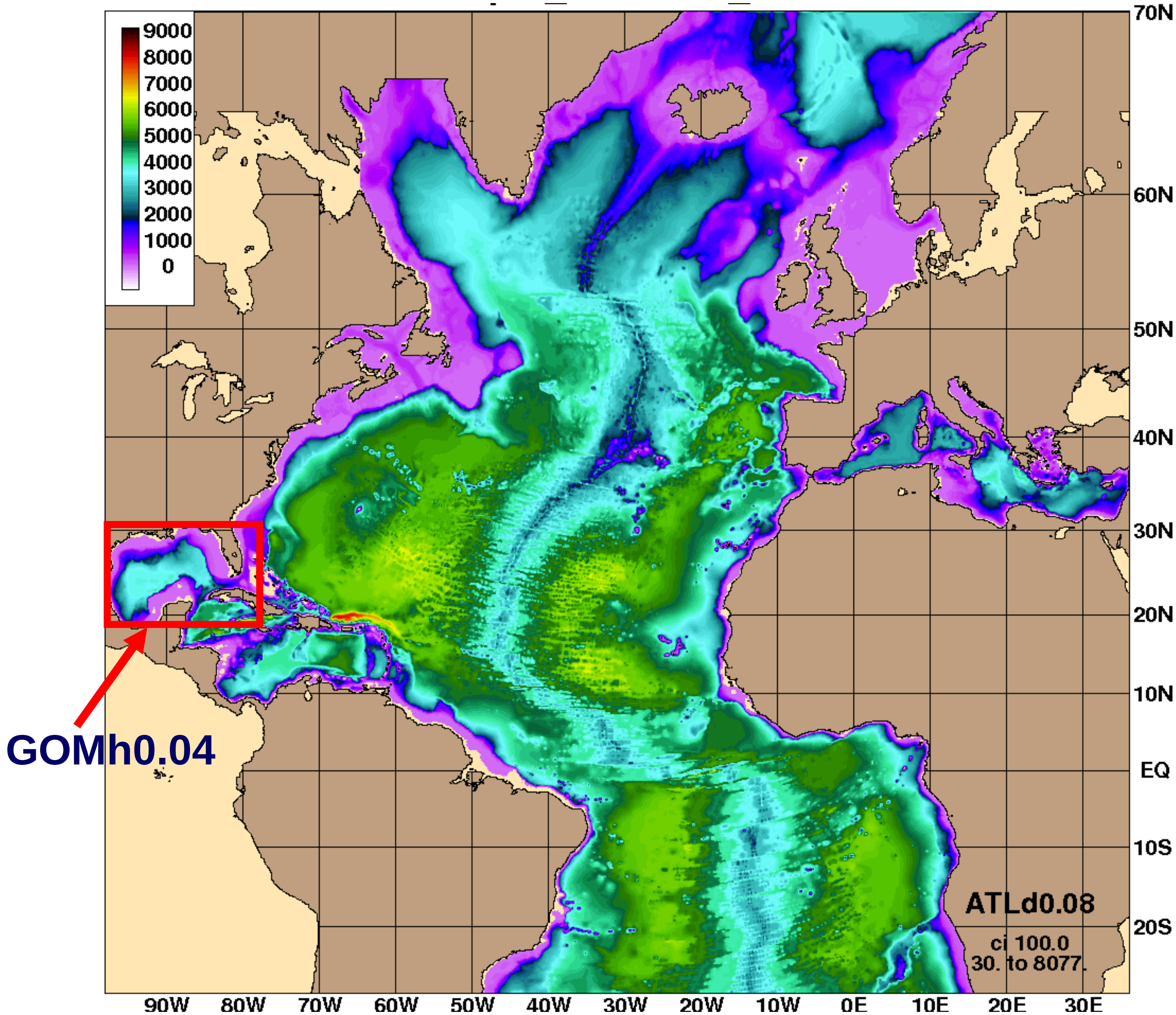
2.5%

-2.5%

5%

Impact of Boundary Conditions
– Using HYCOM-GODAE Products

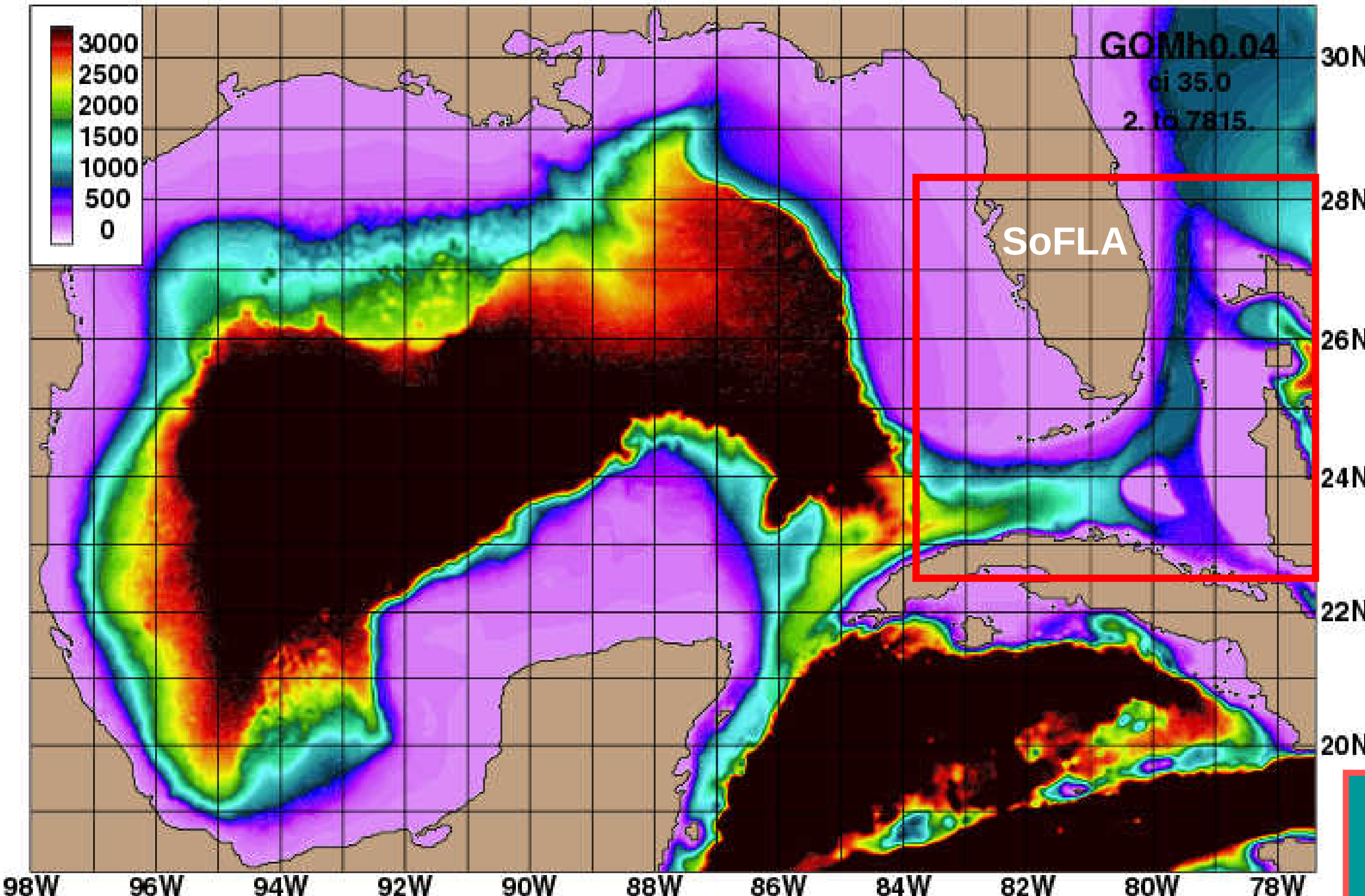
ATLd0.08 Bathymetry



ATLd0.08
1/12° resolution:
98°W–36°E
28°S–70°N
3 m minimum water depth

GOMh0.04
1/25° resolution:
98°W-77.36°W
18.90°N–30.71°N
2 m minimum water depth

GOMh0.04 Bathymetry



FLAh0.04
1/25° resolution:
83.76°W–77.36°W
22.78°N–28.61°N
2 m minimum water depth

FLAh0.04 shares the same grid with GOMh0.04 within the SoFLA domain

Attributes for Model Experiments

GODAE products

Run ID	Domain	Grid	Layer	Forcing	Run type	Nesting/ relaxation
ATLd091	N. Atlantic	1/12°	20	nogaps 1-deg*	OI[1]	Levitus climatology
GOMh200	Gulf of Mexico	1/25°	20	nogaps 1-deg	NCODA[2]	ATLd091 climatology
FLAh291	So. FLA	1/25°	20	nogaps 1-deg	Free	GOMh200
FLAh271	So. FLA	1/25°	20	coamps 27km**	Free	GOMh200
FLAh025	So. FLA	1/25°	26	coamps 27km	Free	GOMh200
FLAh391	So. FLA	1/25°	20	coamps 27km	Free	ATLd091
ATLn303	N. Atlantic	1/3°	28	NCEP***	Free	Levitus climatology

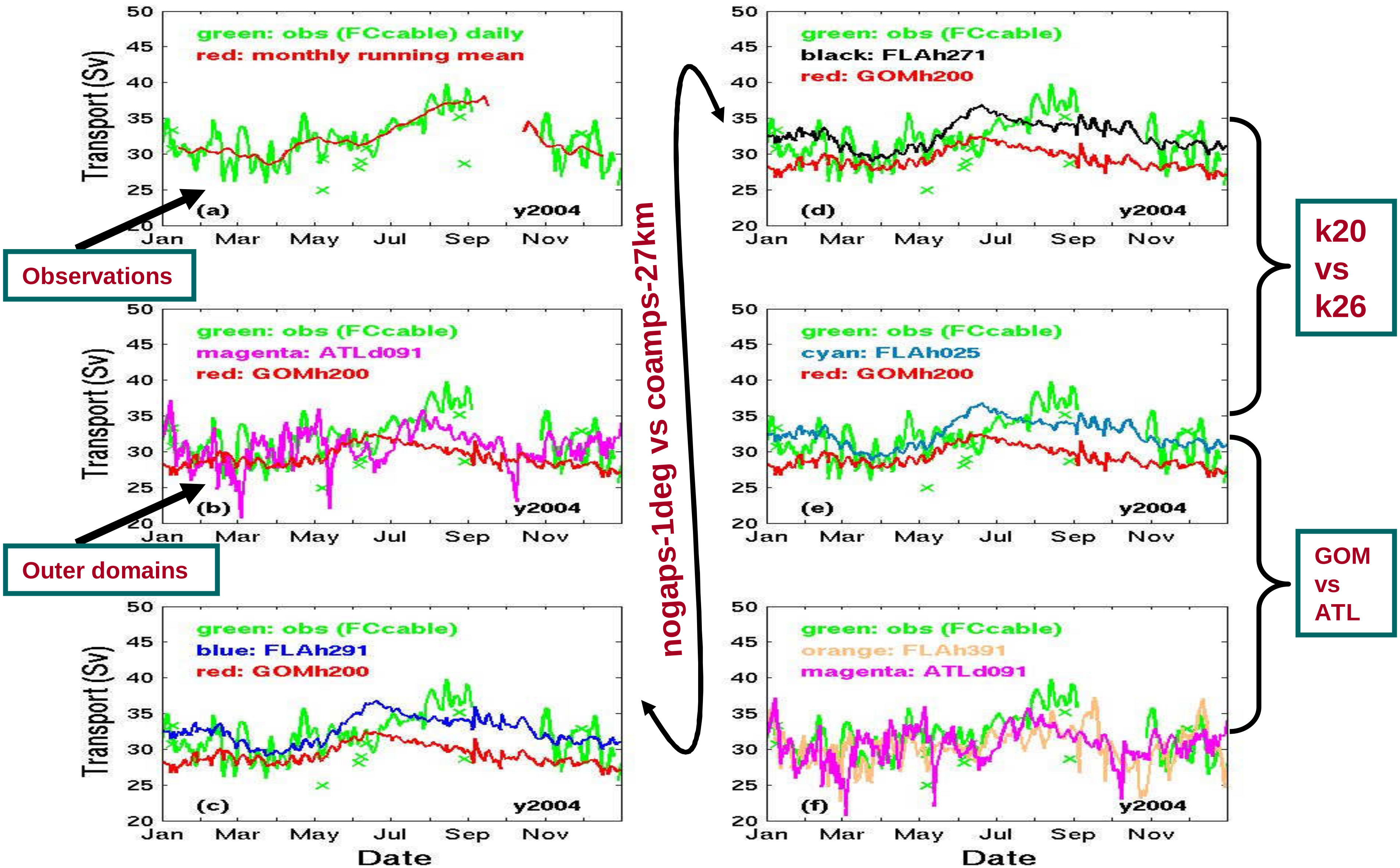
*** nogaps 1-deg: one–degree, 3-hourly atmospheric forcing data set from the Navy’s Operational Global Atmospheric Prediction System (NOGAPS) .**

**** coamps 27 km: 27 km, 3-hourly atmospheric forcing data set from the Coupled Ocean Atmosphere Prediction System (COAMPS).**

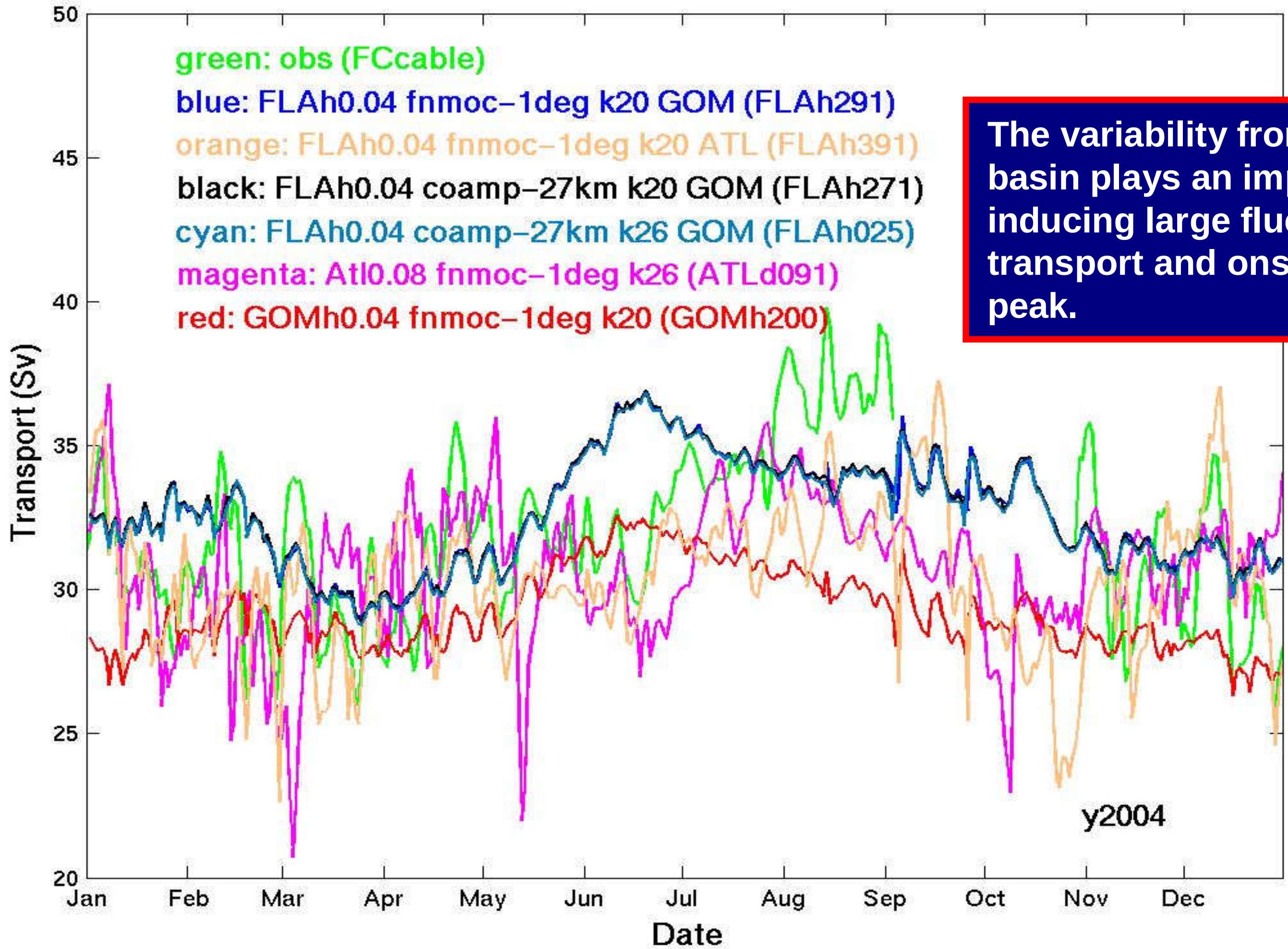
****** NCEP: 6-hourly atmospheric forcing from the NCEP/NCAR (before 1979) and NCEP/DOE AMIPS-II (after 1979) on a T62 grid which yields a resolution of about 2.5° x 2.5°.**

[1] Optimal Interpolation scheme [2] the Navy Coupled Ocean Data Assimilation (NCODA) system

Cable Data and HYCOM: FC Transport at ~27N Year 2004



Cable Data and HYCOM: FC Transport ~27ºN Year 2004

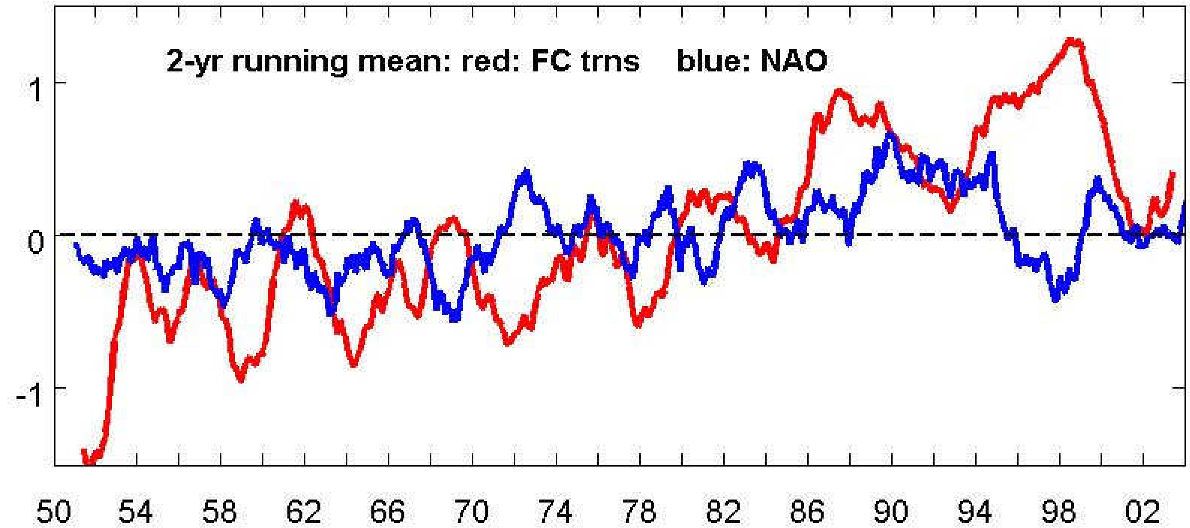


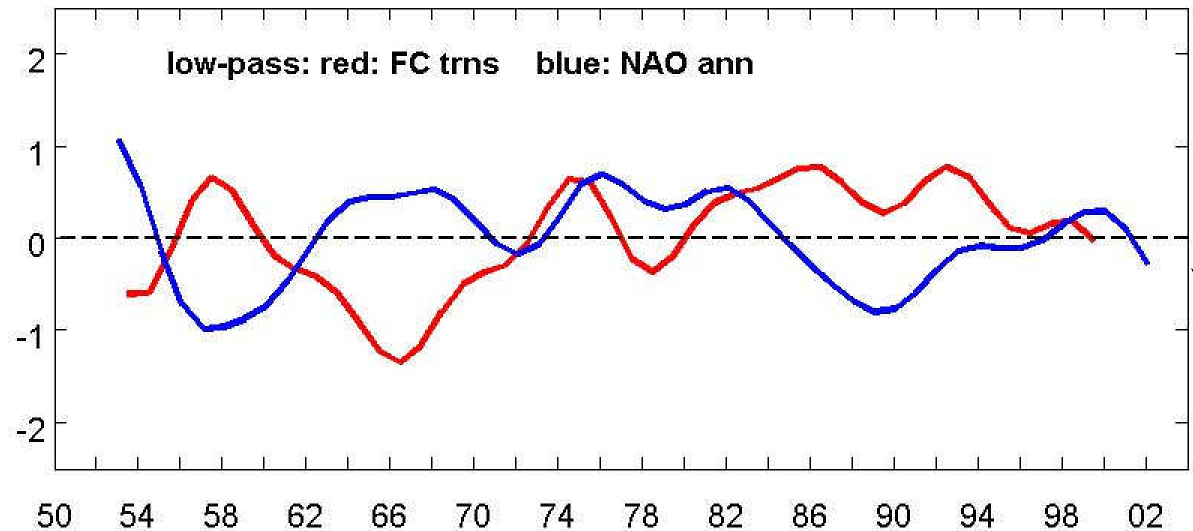
The variability from Atlantic basin plays an important role in inducing large fluctuations of FC transport and onset of summer peak.

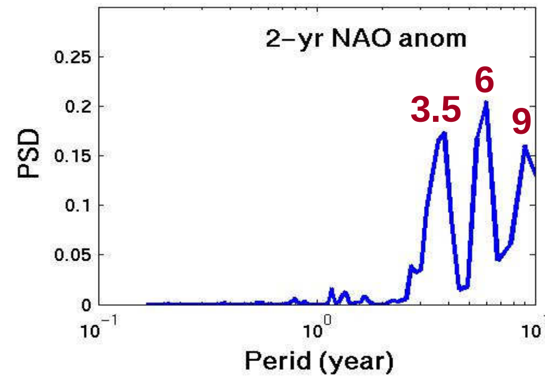
FC transport at 27ºN is not sensitive to the resolution of local atmospheric forcing; neither is to the vertical resolution of the model.

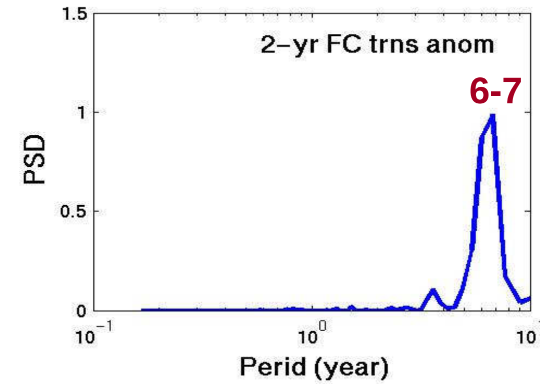
Inter-annual and decadal variability
→A model study (1950-2003)

HYCOM: FC Transport ~27ºN



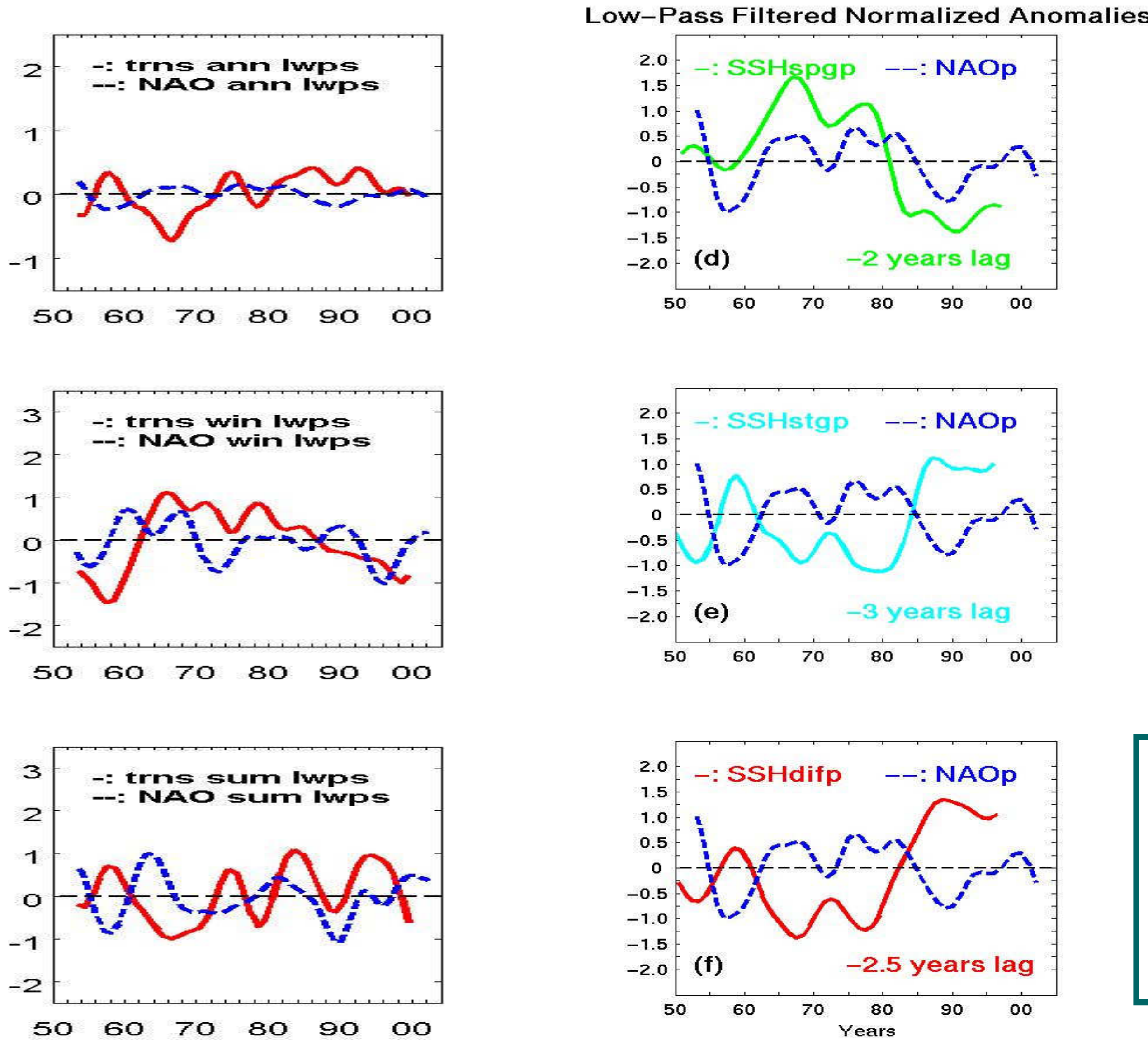






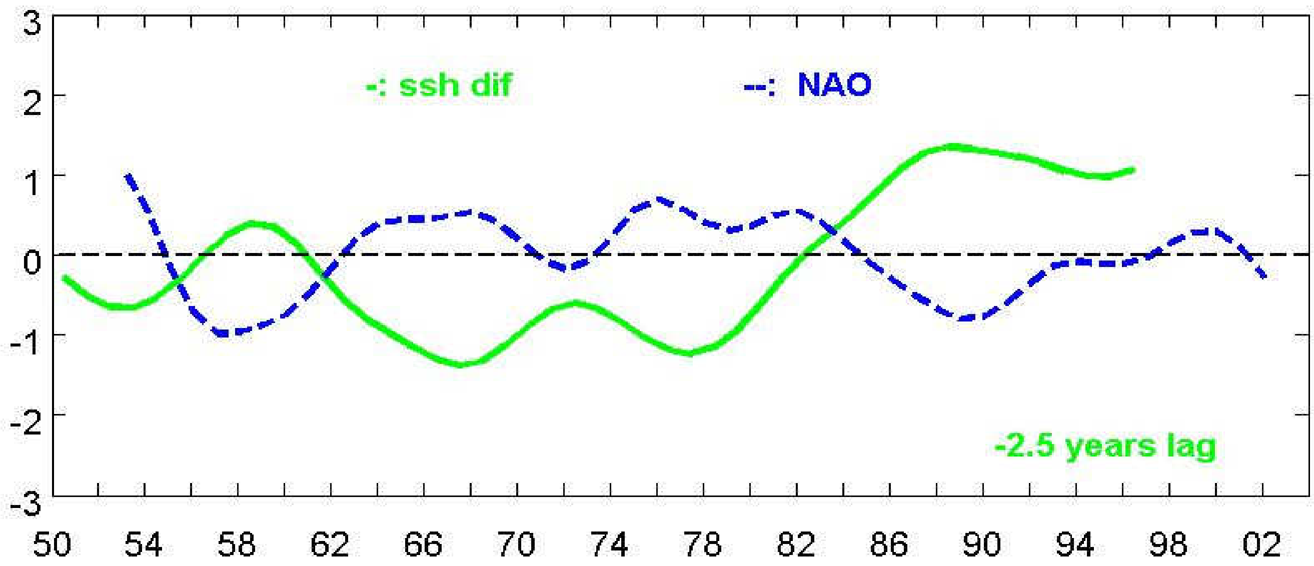
Modeled FC transport is only loosely correlated with NAO: negatively at zero lag (-0.45) and positively with NAO at a 7- year lag (0.59).

win: DJFM   sum: JJAS

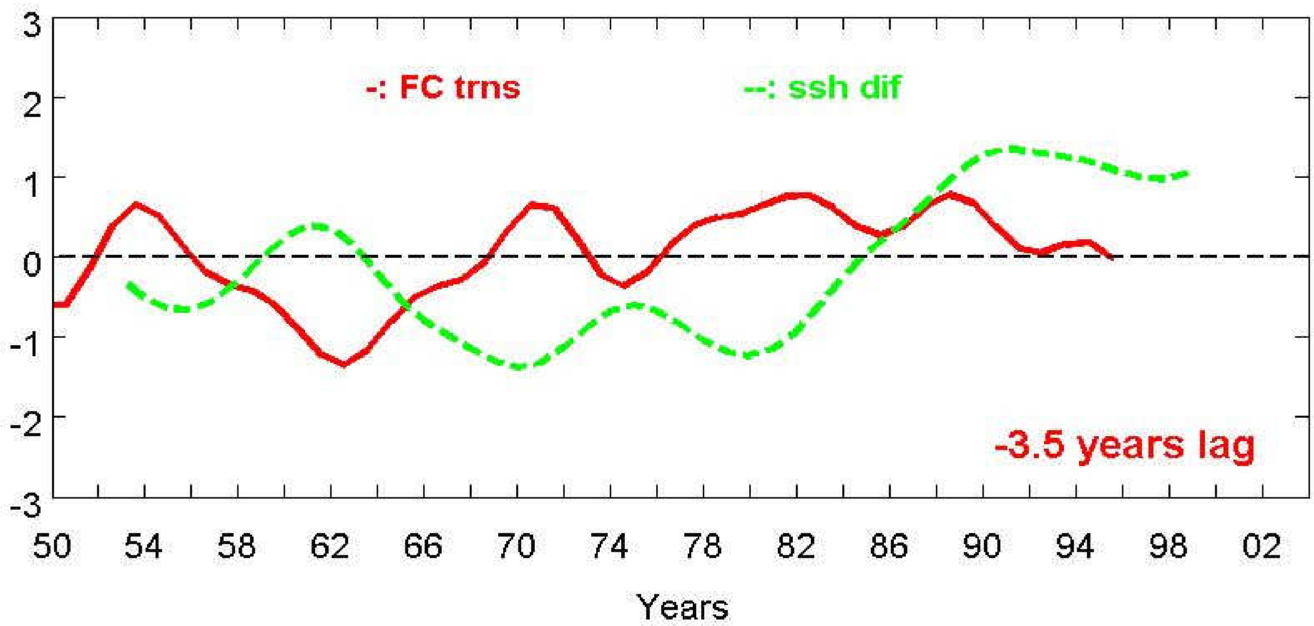


sshdif: the difference between Sea Surface Height (SSH) at the subpolar gyre and SSH at the subtropical gyre.

HYCOM: FC Transport ~27ºN Year 1950 - 2003



The maximum correlation coefficient is 0.81.



The maximum correlation coefficient is 0.71.

Summary

- A minimum (maximum) in March is found in cable FC transport for the strong positive (negative) NAO regime. The onset of the summer peak is in May for strong positive NAOs but in July for the strong negative NAOs.
- The variation of the mean values of FC transport for those two regimes is about 5%, which is on the order of observed fluctuations.
- The FC transport is sensitive to the boundary conditions. The major influence on the fluctuations of FC transport on time scales of a few days to a few weeks is found to be from the North Atlantic basin.
- On decadal time scales, the modeled FC transport is loosely correlated with NAO: negatively at zero-lag and positively at a 7-year lag. The sshdif is shown to be a better indicator as it is better correlated with both NAO and FC transport, with sshdif leading FC transport by about 3-4 years. This implies that FC transport is more controlled by the internal ocean dynamics forced by NAO rather than by NAO itself.

Acknowledgement

- Patrick Hogan, NRL
- Alan Wallcraft, NRL

Help in model domain configurations and HYCOM related issues

- Molly Baringer, AOML/NOAA → Cable measurements
- Zhijin Li, JPL → Discussion on statistical analysis
- The Office of Naval Research
- The National Ocean Partnership Program
- The NOAA Coastal Ocean Program and Office of Climate Observations

Funding